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TITLE: MULTIPLE CALL WAITING IN A PACKETIZED COMMUNICATION  
SYSTEM

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Summary of Invention Paragraph - BSTX (7):

[0005] Due to this limitation, when a third incoming call comes in for the party involved in two other calls, the PSTN called party cannot toggle to the third incoming call. Instead, a busy signal is returned to the third caller or the call is routed to a voice answering system. At no time during the call is the called party apprised of the existence of the call. Thus, there is a need to expand the functionality of the call waiting service to provide the ability to alert the users of additional incoming calls and allow the user the opportunity to answer multiple incoming calls by providing a call waiting queue.

Detail Description Paragraph - DETX (5):

[0027] Again referring to FIG. 1, the broadband network 1 may include one or more customer premises equipment (CPE) units 102. The customer premise equipment 102 may be variously configured. In one example, the customer premise equipment 102 may include one or more local control devices such as a broadband residential gateway (BRG) 300. Although the broadband residential gateway is preferably disposed in a residence for many aspects of the invention, in exemplary embodiments, it may also be disposed in a business or other location. The broadband residential gateway 300 may be variously configured to provide one or more integrated communication interfaces to other devices within the customer premise equipment 102 such as televisions (TV), personal computers (PC), plain old telephone system (POTS) phone(s), video phones, IP enabled phones, and other devices. For example, the broadband residential gateway 300 may provide one or more telephone port connections (e.g., plain old telephone system), Ethernet connections, coaxial connections, fiber distributed data interface (FDDI) connections, wireless local area network (LAN) connections, firewire connections, and/or other connections to a plurality of devices such as plain old telephones, IP based phones, television converters, e.g., cable television (CATV) set top devices, televisions, digital televisions, high definition televisions (HDTV), video phones, and other devices. In exemplary embodiments, the broadband residential gateway 300 may support communications between any of the aforementioned devices in

intra-premises calling and/or extra-premises calling. Further, when the broadband residential gateway 300 is used in a business environment, it can function as a private branch exchange or key type telephone system.

Detail Description Paragraph - DETX (15):

[0037] The IP network 120 and/or ATM network 185 may include one or more routers and/or other devices to route, for example, telephony calls, multimedia calls, signaling messages, administrative messages, programming messages and/or computer data between the various devices in the broadband network 1 such as the head-end hub 115, the public switched telephone network 160, the private branch exchange (PBX) 146, as well as the other devices discussed above. In preferred embodiments, the information traveling in the IP network 120 may be packetized and formatted in accordance with one of the Internet protocols. The IP network 120 may also include gateways to interface with the various other networks and/or devices. For example, the gateways may be distributed at the edge of the IP network where the IP network interfaces with one of the other devices or networks. Alternatively, the gateways interfacing the IP central station 200 to, for example, the Internet 180, public switched telephone network (PSTN) 160, signaling system 7 (SS7) 170, wireless networks 144, ATM/frame/cell relay networks 185 may be provided in the IP central station 200, or in both the IP network 120 and the IP central station 200, and/or partially distributed between the IP network 120 and the IP central station 200. Where an IP network 200 separates the gateways, an appropriate transport protocol may be utilized to logically connect the IP central station 200 to the particular gateway.

Detail Description Paragraph - DETX (16):

[0038] The IP central station(s) 200 may be connected to, for example, one or more IP networks 120, ATM networks 185, secure management data networks 190, and/or administration centers 155. The IP central station 200 may be variously configured to include one or more servers and/or one or more gateways. In exemplary embodiments, the servers and gateways provide the necessary intelligence and traffic management capabilities to enable information, e.g., IP telephony signals, to travel through the broadband network 1. For example, the IP central station 200 may be configured to manage voice information transfer from the public switched telephone network 160, through the IP network 120, and into and out of one or more devices such as those connected to a broadband residential gateway 300. The IP central station may be configured to store various control and system information such as location, address, and/or configurations of one or more broadband residential gateways 300, as well as other routing and call set-up information.

Detail Description Paragraph - DETX (18):

[0040] The IP network 120 and/or the ATM network 185 illustrated in FIG. 1 may include one or a plurality of sub-networks. Each of the sub-networks may include its own IP central station 200 in a distributed configuration, with certain routing data replicated across all IP central stations or each sub-network may be connected to a single centralized IP central station 200. Where the IP network 120 includes one or more sub-networks, each sub-network may be connected to multiple head-end hubs 115. Further, each head-end hub

115 may be connected to multiple hybrid fiber-coaxial plants 112, and each hybrid fiber-coaxial plant 112 may be connected to multiple pieces of customer premises equipment 102 and/or broadband residential gateways 300. The IP network 120 provides an interconnected broadband network which may be utilized to transport and route packetized information to and from diverse geographic locations and may be used on a national or international basis. Further, the IP network 120 and/or ATM network 185 may utilize private network facilities and/or may be provisioned over a shared network such as the Internet.

Detail Description Paragraph - DETX (22):

[0044] Again referring now to FIG. 2, the IP central station 200 may include a central router 200, for example, a gigabit switch, which may be utilized to interconnect various servers and gateways contained in the IP central station 200. The central router 210 provides for example Ethernet switching and aggregate traffic between servers, gateways and the IP network 120 and/or ATM network 185 backbone. In one exemplary embodiment, the central router 210 provides high-speed, non-blocking IP and IP multicast Layer 3 switching and routing. The IP central station 200 may include one or more of the following servers: the least cost server (LCS) 255, the time of day (TOD) server 212, the dynamic host control protocol (DHCP) server, the trivial file transfer protocol (TFTP) server, and the domain name service (DNS) server 214, the system management (SM) server 216, the call manager (CM) server 218, the announcement server (AS) 220, the multimedia server (MS) 222, and/or the conference server (CS) 224. As illustrated in FIG. 2, the servers may be separate servers, for example the call manager server 218, or may be incorporated into a single server. In the exemplary embodiment, the dynamic host control protocol server 131, trivial file transfer protocol service server 132, and the domain name service server 214 are each incorporated in a single server facility. Each server in the IP central station 200 may include computer(s), storage device(s), and specialized software for implementing particular predefined functions associated with each server. In this manner, the servers in the IP central station may be provisioned as a main server and one or more back-up servers to provide redundant processing capabilities. Similarly, the router may be implemented as a main router and a back-up router with similar routing functionality.

Detail Description Paragraph - DETX (24):

[0046] In exemplary embodiments, the dynamic host control protocol server and domain name service server 214 may operate to dynamically assign IP addresses devices in the customer premise equipment 102. Where a dynamic IP assignment scheme is used, the customer premises equipment may be provided with one or a plurality of dynamic IP assignment when activated initially, and/or at the initiation of each active secession. Where an IP address is assigned when the device is initially activated, it may be desirable to assign a single IP address to a single broadband residential gateway and assign a port address to devices connected to the broadband residential gateway 300. In other embodiments, an individual IP address may be assigned to each device coupled to the broadband residential gateway 300. For example, the broadband residential gateway may include and/or be coupled to one or more cable modems, IP phones, plain old telephone system phones, computers, wireless devices, CATV converters, video phones, and/or other devices which each may be assigned a

unique static and/or dynamic IP address and/or a port of a one of these IP addresses. The particular protocol for allocating IP addresses and/or ports may be specified using protocols defined in the dynamic host control protocol server 214. In exemplary embodiments, the dynamic host control protocol and DN server 214 may be configured to assign available IP addresses from address pools based, for example, on the identity or type of requesting device, the amount of use expected for the requesting device, and/or predefined assignment protocols defined in the dynamic host control protocol and DN server 214. In centralized embodiments, it may be desirable to configure the call manager (CM) 218 to provide sufficient information such that the domain name service server 214 can distinguish between static IP devices, dynamic IP devices, registered devices, unregistered devices, and registered devices that have been assigned to a particular class of service e.g., data vs. telephony, un-provisioned, vs. provisioned, etc.

Detail Description Paragraph - DETX (28):

[0050] The least cost server (LCS) 255 may be variously configured to enable the system to determine the least cost routing of telephone and data transmission throughout the network. The least cost server 255 may also provide one or more broadband residential gateway users capability to select between, for example, cost and Quality of Service (QoS).

Detail Description Paragraph - DETX (34):

[0056] The call manager 218 may also be configured to maintain the call states for each call it handles (e.g., a voice over IP call) and respond to system events created by, for example, the multimedia gateway control protocol (MGCP) messages and/or integrated services digital network user part (ISUP) messages for signaling system 7 (SS7) protocol that may occur during the processing of a call. Exemplary events handled by the call manager 218 include call state changes, call feature changes/call feature triggering events, changes in the status of lines and trunks, and/or error conditions. Further, the call manager 218 may interact with devices connected to a single circuit on the public switched telephone network 160 and/or a device connected to a port of the broadband residential gateway 300. In this manner, new devices may be added to the infrastructure and operate using the open call model contained in the call manager 218.

Detail Description Paragraph - DETX (35):

[0057] The call manager 218 may also include storage for subscriber and network configuration, a cache server for faster access to frequently used data, a routing engine for selecting an appropriate routing algorithm (e.g., least cost routing), and/or a service broker which provides the data and logic for specific services. In addition, the call manager 218 may include an authentication (AC) server 245 that provides authentication of various devices, objects, packets and users in the integrated multimedia system. In this manner, a user may verify the identity of the calling or called party.

Detail Description Paragraph - DETX (36):

[0058] The call manager 218 may interact with the signaling gateway (SG)

234, the accounting gateway (AG) 240, the element management gateway (EMG) 238, the voice gateway (VG) 232, and the multimedia gateway (MG) 230 using any suitable protocol such as IP and an interconnection mechanism such as the central router 210. In one preferred embodiment, the call manager 218 may be configured to utilize signaling messages such as: a) ISUP messages over Common Object Broker Architecture (COBRA) interface to and/or from signaling gateway 234, b) MGCP, SIP--simple internet protocol, H.GCP, and/or other suitable control messages to and/or from the announcement server 220, c) call event records in modified Radius format to the accounting gateway 240, d) Radius (or Enhanced Radius or compatible protocol) control messages to and/or from the voice gateway 232 and/or the broadband residential gateways 300, and e) signaling network management protocol (SNMP) messages to and/or from the element management gateway 238.

Detail Description Paragraph - DETX (37):

[0059] The call manager 218 may incorporate one or more databases. For example, the call manager 218 may include database information such as (1) a resources database that provides an identification of what resources are connected to the broadband network 1 and their current state; (2) a trunk/gateway database that indicates which gateway serves what circuits in a trunk; (3) a customer database which indicates whether a call is authorized, identifies what services a line supports and determines whether a telephone number is on or off the integrated IP communication network; (4) a numbering plan/least cost routing database which provides routing information that enables the IP central station 200 to choose the correct trunk as a function of the call number; and (5) a local number portability (LNP) database that indicates the North American Numbering Plan (NANP) and associated prefixes which are open for association with the number portability service; and (6) an address of the service control point (SCP) towards which requests for translating these local portability numbers should be routed.

Detail Description Paragraph - DETX (43):

[0065] The IP central station 200 may be variously connected to the public switched telephone network. For example, the IP central station 200 may be connected directly to the public switched telephone network using, for example a bearer channel (e.g., a T1 or T3 carrier) and/or interconnected using one or more networks such as an IP network and/or ATM/frame/cell relay network 185. Where a T1 network is utilized, it may be desirable to utilize one or more of ISUP or MF, FGD, and OS to interconnect a service bureau in the public switched telephone network 160. Alternatively, the service bureau in the public switched telephone network 160 may be interconnected using an alternative network arrangement such as an IP network 120 and/or a ATM/frame/cell relay network 185. The service bureau may coordinate with the IP central station 200 in providing operator services, directory services and provisioning for 311, 611, and 711 services. Emergency 911 services may be routed to an E911 tandem switch that has the appropriate databases and interfaces with a Public Safety Answering Position (PSAP). Emergency 911 services may be coordinated by the call manager 218 and/or public switched telephone network based service bureau.

Detail Description Paragraph - DETX (44):

[0066] Voice gateway 232 may be router-based and include one or more voice feature cards and/or DSP Module cards to perform voice processing. The voice gateway 232 may optionally include host processors, LAN/WAN ports, Ethernet ports, T1 or E1 telephony interface cards, Voice Feature Cards with DSP Modules providing voice compression transcoding (G.711 and G.729), carrier-quality echo cancellation with 8 ms-32 ms tail length, a de-jitter buffer which adapts to delay variations in the network in order to minimize the delay, packet loss concealment that generates concealment frames for lost packets using information from previously received data, and/or tone detection and generation. This function detects Multi-Frequency (MF) tones and generates MF and call processing tones (e.g. dial tone, call-waiting tone etc.).

Detail Description Paragraph - DETX (46):

[0068] An Ethernet interface with a RJ-45 connector may be used to connect the voice gateway 232 to the central router 210 (e.g., Gigabit Switch or High Speed Router (HSR)). The multimedia gateway control protocol may be used as the interface between the voice gateway 232 and the call manager 218. For example, call control, signaling, and multimedia data stream, real time protocol (RTP) connections, IP addresses, UDP ports, codec choice etc, may be configured in any suitable manner such as by using a multimedia gateway control protocol. In exemplary embodiments, audio streams may be passed directly between customer premises equipment 102 using real time protocol connections over, for example, a user datagram protocol (UDP). Thus, the multimedia gateway control protocol may be utilized to request the voice gateway 232 to initiate, cancel, and/or otherwise modify connections in order to set up and tear down RTP media streams. A similar procedure may also be utilized to request continuity tests and results.

Detail Description Paragraph - DETX (48):

[0070] The point where ISUP and TCAP messages are terminated at a signaling system 7 (SS7) signaling gateway is defined as a Service Switching Point (SSP) to the signaling system 7 (SS7) network 170. The call manager 218 may be configured with a standardized Application Programming Interface (API) to allow interaction with the signaling system 7 (SS7) by, for example, sending and/or receiving ISUP and TCAP messages from a service switching point (SSP). Full class 5 signaling system 7 (SS7) functionality may be included in the call manager 218 including the ability to provide all of the information necessary for billing as defined in the GR-246-Bellcore standard. The signaling gateway 234 may be arranged to perform: signaling system 7 (SS7) message handling (message discrimination, message distribution, and message routing); signaling link management (e.g., link activation, deactivation); signaling route management (managing Point Code [PC] route status based on route received management messages such as Transfer Prohibited, Transfer Allowed, Transfer Restricted, etc.); and signaling traffic management (diversion of traffic based on unavailability, availability, restriction of signaling link, route, and Point Code.) The signaling system 7 (SS7) architecture supports the necessary redundancy component scheme for system reliability and availability during scheduled maintenance and/or software/hardware upgrades. The signaling gateway 234 may be configured to directly provide for lower level signaling system 7 (SS7) processing.

Detail Description Paragraph - DETX (49):

[0071] In exemplary embodiments, the signaling gateway 234 interacts with the call manager 218 using an appropriate open interface (e.g., Common Object Request Broker Architecture (COBRA)). In these embodiments, it may be desirable for translation software in the signaling gateway 234 to add Message Transfer Part (MTP) layer information to the ISUP and/or TCAP data to create a complete signaling system 7 (SS7) message. The complete signaling system 7 message may then be sent to the Signaling Transfer Point (STP) in the external signaling system 7 (SS7) network 170. Conversely, the signaling gateway 234 may be configured to remove ISUP or TCAP application layer data from the signaling system 7 (SS7) messages received from the STP prior to converting the information to an appropriate open interface (e.g., COBRA) and forwarding the information to the call manager 218 via the central router 210.

Detail Description Paragraph - DETX (50):

[0072] The accounting gateway (AG) 240 may be configured to receive messages representing events from the call manager 218 via a suitable transport mechanism such as the central router 210. Typically, two messages are received for each call, the first when the call is established, and second when the call terminates. In the case of unsuccessful calls, only the failure message will be logged. The messages provide details about the calling and called parties, the timing of the call set-up, the duration and the quality of the call. Accounting gateway 240 may be duplicated using a redundant computer, with each gateway having dual-mirrored disks. The accounting gateway 240 stores usage records and may then distribute them to linked destinations (e.g., billing centers) for processing. Billing centers typically include bill processors that receive accounting information from the accounting gateway 240 and generate appropriate on-line or paper billing to customers. The accounting gateway may be configured to accommodate multiple days worth of accounting records such as the records for one day, two days, three days, four days, a week, or a month. The period in which the data is retained in the accounting gateway may be dependent on business needs, hardware restrictions, and/or the billing cycle. For example, as the end of the billing cycle nears, it may be desirable to shorten the period the accounting gateway holds the data such that calls placed the day the bills are printed are included on the bills. Further, the accounting gateway may both retain and forward data to the billing centers. In this manner, if the equipment at the billing center fails, the accounting gateway 240 may serve as a backup. Similarly, the billing center may act as a backup where the accounting gateway 240 fails.

Detail Description Paragraph - DETX (54):

[0076] The Internet gateway (IG) 236 may be connected to the Internet (e.g., World Wide Web (www)) and provide a means for IP based data packets to be routed between the IP network 120 and the Internet 180. Alternatively, IP based voice packets may be routed via the Internet 180. In exemplary embodiments, the Internet gateway 236 routes data-only packets which share the same priority level with other lower priority, non-real-time traffic consistent with computer data communications presently experienced with the Internet 180. Consequently, low priority and low latency data traffic on the IP network 120 utilize the Internet gateway 236 to communicate with other IP data networks

such as the www. Voice packets may be routed through another network such as the ATM/frame/cell relay network 185, a private IP network 120, and/or the public switched telephone network 160 where committed information rates may be easily obtained.

Detail Description Paragraph - DETX (59):

[0081] Where the elements of the broadband residential gateway 300 are interconnected, the interconnection may be provided by one or more data buses, for example, a high speed bus (HSB) 360, processor bus 380, and/or other interconnection system. The high speed bus 360, 380 may be configured to provide a flexible conduit for transferring information between the internal hardware, processors and ports. In exemplary embodiments of the broadband residential gateway 300, the high speed bus 360 may include one or more of the following functional units a) a universal remote control receiver module 365 for receiving wireless (e.g., infrared, and/or RF) signals (e.g., keyboard signals and/or remote control signals) for control of the broadband residential gateway 300 and/or any connected devices, b) a display, display driver, touch screen logic module for driving one or more local and/or remote displays for interfacing with the broadband residential gateway 300 and/or one or more connected devices, c) one or more TV port modules 336 for interconnecting televisions, set-top devices, and/or other audiovisual devices to the broadband residential gateway 300, d) one or more data port modules 334 for connecting/interconnecting data enabled devices (e.g., personal computers, palm top devices, etc.), e) one or more telephony port modules 332 for interconnecting one or more analog and/or digital telephones, f) one or more peripheral port modules 342 for interconnecting one or more peripheral devices such as disk drives, data storage devices, video cassette recorders, DVD devices, audio devices, video devices (e.g., camcorders, digital cameras, digital video recorders, stereos, etc.), g) one or more external/internal intercom modules 344 for interconnecting remote intercom and/or security monitoring devices, h) one or more wireless interface modules 345 for interconnecting with various wireless extension devices such as wireless TVs, cordless and/or wireless telephones, wireless LANs, etc., i) one or more voice recognition/voice synthesis modules 355 for generating voice announcements, voice messages, and voice prompts and for recognizing voice generated commands and data, j) set-top box module 350 for performing the functions associated with a set-top box locally and/or for communicating with one or more remotely coupled set-top boxes, k) memory 322 (e.g., DRAM, RAM, flash, and/or other memory) for storing information and operating data within the broadband residential gateway 300, l) transceiver 302 for communicating with one or more external broadband networks m) operating program store 330 (e.g., ROM, flash, etc.) for storing at least portions of the operating programs for the broadband residential gateway 300 and/or interconnected devices, n) security processor, smart card and/or credit card interface module 340 for providing secure processing functions and/or credit card/smart card transaction functions, and/or o) distributed processing controller 306 which may be a microprocessor and/or one or more interconnected distributed processing modules for controlling the broadband residential gateway 300. Where the distributed processing controller 306 includes one or more distributed processing modules, the modules may include a telephony processing module (P1) 308, data processing module (P23) 310, video processing module (P3) 312, auxiliary processing module (P4) 314, IP processing module (P5) 316, and/or an operations administration



maintenance and provisioning processing module (P6) 318 interconnected through one or more busses such as processor bus 380. The processor bus 380 and/or high speed bus 360 may include any suitable interconnect bus including intelligent bus configurations incorporating smart buffer logic (not shown in FIG. 3) to facilitate data transfer between interconnected processors and/or modules. The various modules and/or processing components of the broadband residential gateway 300 may be powered by, for example, a power supply unit (not shown). Each of the individual modules of the broadband residential gateway will now be described in more detail.

Detail Description Paragraph - DETX (60):

[0082] The transceiver 302 may include circuits for converting digital signals to and from RF signals suitable for transmission across a broadband network such as the hybrid fiber-coaxial plant 112. The transceiver 302 may include one or more input/output ports such as a cable interface (e.g., an F connector cable connection) and/or a fiber optic interface connected to a communication media (e.g., hybrid fiber-coaxial Plant 112). The transceiver 302 may be compatible with the DOCSIS 1.0 or later specifications. For signaling purposes, the broadband residential gateway 300 may be compatible with the Media Gateway Control Protocol (MGCP) or other compatible signaling protocol (e.g., SIP or H.GCP) to support telephony applications. The transceiver 302 may serve as a modem, a translator and/or a multiplexor/demultiplexor. Data received from the network may be de-multiplexed and placed on the data bus for dispatch to the appropriate peripherals and/or ports. Data from the various ports and peripherals may be multiplexed together for distribution over one or more broadband networks (e.g., the hybrid fiber-coaxial (HFC) plant 112). Where a hybrid fiber-coaxial plant 112 is utilized, the data may be multiplexed onto various frequency bands of the hybrid fiber-coaxial plant 112 in a continuous data stream(s) and/or packetized data stream(s). To facilitate data transfer for various networks, the transceiver 302 may include one or more registers for data queuing and/or IP tunneling of data packets across the broadband network.

Detail Description Paragraph - DETX (62):

[0084] The peripheral ports module 342 may include a plurality of ports providing connectivity to external peripherals. Exemplary interfaces include, PCI, Firewire, USB, DB25, etc. Devices which incorporate one or more of these interfaces may utilize the broadband residential gateway 300 to interconnect to the remainder of the broadband network 1.

Detail Description Paragraph - DETX (63):

[0085] The external/internal Intercom Module (IM) 344 may include one or more microphones/speakers, voice CODECs, telephony processors, and/or interface ports. Where an intercom module 344 is utilized, the built-in circuitry may be configured to detect, for example, unused plain old telephone system telephone(s) and generates a special intercom tone on these unused telephones. In this manner, existing plain old telephone system telephones, digital phones, and/or other devices may serve as an intercom throughout the residence. The controller 306 (e.g., such as the P1 telephony processor 308) may function to command the intercom module 344 to determine an appropriate intercom path to

select an intercom connection between various locations. In exemplary embodiments, the CODEC may be configured to convert the analog voice signal into IP packets for transmission over one or more data ports 334, TV ports 336, display modules 338, telephony ports 332, peripheral ports 342, external/internal intercom ports 344, wireless interface ports 345, and/or set-top boxes 350.

Detail Description Paragraph - DETX (67):

[0089] The Distributed Processing Controller 306 with its associated processors (P1-P6) may be coupled to the various elements of the broadband residential gateway 300 so as to enable proper operation of each of the individual components. For example, the distributed processing controller 306 (with any associated processors (P1-P6)) may also be coupled to the security processor, smart card/credit card, and interface module 340, the peripheral port(s) module 342, and/or the External/Internal Intercom Module 344 for providing control and coordination among devices coupled to the high speed bus 360.

Detail Description Paragraph - DETX (73):

[0095] As previously indicated, smart buffer logic (SBL) may be coupled to the telephony port(s) 332, data port(s) 334, TV port(s) 336, peripheral port(s) 342, and/or the distributed processing controller (DPC) 306. Where the smart buffer logic is utilized, it may function to buffer the IP packets for delivery over the communication network such as the hybrid fiber-coaxial plant 112. In addition, the smart buffer logic may include selectable switching and routing algorithms based on services and applications associated with each port. Depending on the destination of the IP traffic, the smart buffer logic may multiplex signal from various devices to effect faster information transfer. The smart buffer logic may also allow direct memory access between memory 322 and one or more of the devices and/or ports coupled to the high speed bus 360.

Detail Description Paragraph - DETX (74):

[0096] The telephony port(s) 332 may include various interface circuitry (e.g., analog interface, logic and firmware for interfacing with the Plain Old Telephone (POTs) telephones). Also the telephony port(s) 332 may also be configured to include user interface logic, voice processing logic, voice activity detector logic, voice CODECs, and DTMF (dual tone multi-frequency) tone sensing logic. Echo cancellation and automatic gain control may also be utilized in the telephony port(s) 332 circuitry. In one embodiment, RJ-11 connectors for a plurality of lines (e.g., 4) are provided for connection to one or more existing plain old telephone system 110 telephone units. However, the broadband residential gateway 300 may contain any number of telephone connection ports. In this manner, any number of existing user phone may be connected directly to the broadband residential gateway 300 without modification. Alternatively, the broadband residential gateway can be configured to support, in addition to or as alternative to the plain old telephone system telephone units, ISDN telephones and/or other digital phones (e.g., IP telephones) using an appropriate interface.

Detail Description Paragraph - DETX (75):

[0097] The data port(s) 334 interface may be variously configured. In one configuration, the data ports include high speed data service connections to, for example, a personal computer (PC) using a LAN connection. For example, the data ports 334 may include an Ethernet 802.3 connection compatible with category 5 unshielded twisted pair (UTP) cable and a RJ-45 connector. The data port(s) 334 may include the necessary interface circuitry for coupling to remote computers.

Detail Description Paragraph - DETX (76):

[0098] The TV port(s) 336 may include an interface for conventional television, HDTV and/or CATV services. The TV port(s) 336 typically have one or more F-connectors used for coaxial cable connection to a TV set(s). The TV ports may be configured to connect to a set top box (STB) via the F-connector or directly to a remote television. In embodiments where the settop box is co-located with the television, the data supplied over the TV ports may be either analog and/or digital information. Where the settop box is integrated into and/or comprises the broadband residential gateway 300, the TV ports may be analog or compatible with HDTV signals.

Detail Description Paragraph - DETX (79):

[0101] FIG. 4 shows an exemplary embodiment of the broadband network 1 shown in FIGS. 1-3, with like components identified with identical numbers. At the extremities of the integrated communications system is the customer premises equipment unit (CPE) 102, e.g., one or more customer premise equipment 102 at each customer location. The customer premise equipment 102 may be configured to include an integrated communication interface device such as the broadband residential gateway 300. Other customer premise equipment 102 devices such as one or more televisions (TV) 106, personal computers (PC) 108, and telephones 110, etc., may be connected to the broadband residential gateway 300 via various ports as discussed above. The customer premise equipment 102 could include multiple TVs 106, telephones 110, and PCs 108 connected to a single and/or multiple broadband residential gateway 300. Further, in certain embodiments, it may be desirable to divide the broadband residential gateway 300 into more than one physical package. In this manner, certain interface circuitry may be located outside of the home while various processing circuitry may be located near a peripheral device such as in a settop.

Detail Description Paragraph - DETX (80):

[0102] Where the broadband residential gateway 300 is coupled to the hybrid fiber-coaxial plant 112 in accordance with a preferred embodiment of the present invention, it may be configured to provide the user with both information data (e.g., through an Ethernet interface), telephony access, and TV service (e.g., HDTV, Digital TV and/or CATV services). In exemplary embodiments, the hybrid fiber-coaxial plant 112 typically includes both coaxial cable and optical fiber networks, though, where desired, the network may include only coaxial cable or optical fiber. The hybrid fiber-coaxial plant 112 may be coupled to a head-end hub (HEH) 115. The head end hub 115 may provide an interconnection point to gather and/or transform external services (e.g., off air and satellite video, public switched telephone network voice,

and Internet data) into a format suitable for distribution on the hybrid fiber-coaxial plant 112 for use with the customer premise equipment 102. The head-end hub 115 may include one or more cable modem termination systems (CMTS) 116 coupled between the hybrid fiber-coaxial plant 112, a Head-end (HE) 117 and/or an Edge Router (ER) 118. The edge router 118 may be coupled to the cable modem termination system 116 and to one or more ultra high speed routers (UHR) 121. One or more ultra high speed routers 121 may be interconnected to each other and/or through a centralized mechanism such as an IP network database to form a high speed network. The high speed packet network 120n is one example of the network 120 (e.g., IP network) shown in FIG. 1.

Detail Description Paragraph - DETX (81):

[0103] In the embodiment shown in FIG. 4, the high speed network 120n includes the ultra high-speed routers (UHR) 121 configured in a ring configuration. Although this embodiment shows the use of the IP network database (IND) 122, other configurations are also suitable. Where an IP network database 122 is utilized, it may be desirable to incorporate one or more data sets such as: a IP local number portability database (IP LNP) 122a which may be utilized for transferring local DN among service providers when a user changes their service provider; an IP caller name database (IP CNAME) 122b which may be utilized to provide a database of names relating to IP addresses and/or domain names; an IP line information database (IP LIDB) 122c which may provide alternative billing and allow flexibility in determining who pays for a call; and an IP 1-800 Database (IP 8YY) 122d which may provide a database of 1-800 numbers relating to the IP network 120a. Alternatively, the IP local number portability database may be located at another location, such as at an IP central station (IP Central) 130. Where desired, a local service management system (LSMS) 150 may be arranged to provide management of the IP local number portability database. Where a local service management system 150 is utilized, a plurality of local service order administration (LSOA) units 152 may be coupled to the local service management system by, for example, a number portability administration center (NPAC) 151. In this manner, directory numbers may be transported among different service providers. In such a case, a NPAC 151 is generally coupled to the LSMS 150 and uses the LSMS 150 to synchronize the numbering databases and to coordinate the porting process.

Detail Description Paragraph - DETX (82):

[0104] As indicated above, the broadband network 1 may include a plurality of interconnected high performance networks 120n. Each high performance network 120n may include a separate IP central station 200 and/or share a single IP central station. Having distributed IP central stations located throughout the broadband network 1 provides improved performance and quicker response time for an individual user. Although not illustrated, each high performance network 120, 120n may be connected to multiple head-end hubs 115, each head-end hub 115 may be connected to multiple hybrid fiber-coaxial plants 112, and each hybrid fiber-coaxial plant 112 may be connected to a plurality of customer premises equipment 102, each containing one or more broadband residential gateways 300. The plurality of high performance networks 120n may be configured as an interconnected network for routing packetized information from point-to-point in accordance with a desired destination.

Detail Description Paragraph - DETX (89):

[0111] The head-end 117 may originate CATV signals for transmission over the distribution network. However, in alternate embodiments, signals may be inserted at other points in the distribution network, such as at various hubs or may arise at remote locations in the network such as IP central. Down stream channels may be utilized to facilitate the transmission of signals from the head-end or other input distribution point to the subscriber premise. Where analog RF signals arrive at the broadband residential gateway 300 of the customer premise equipment 102, typically, the transceiver circuitry 302 will detect if the signal is addressed to this broadband residential gateway 300. If so, the transceiver will allow reception of the RF signal. Upon conversion to a digital format, the signal is typically output over the high speed bus (HSB) 360 to one or more associated devices for processing. For example, where the signal is a TV signal, the signal may be output directly to the TV port 336 and/or processed by the settop box 350 prior to outputting to the TV ports 336 and/or display 338. Where user channel selection is preformed directly in the broadband residential gateway 300, channel selection may be preformed by remote control receiver 365 using an external device such as a remote control. The remote control receiver may receive a plurality of individually coded remote control commands from different receivers and process the signals for only one associated device in accordance with the received commands. Alternative channel inputs include the display 338 and/or any associated keypad. Authorization to certain channels may be controlled by security processor 340.

Detail Description Paragraph - DETX (96):

[0118] 4. On receiving the dialed digits, the call manager 218 will determine whether local number portability has been enabled. Where local number portability has been enable, the call manager 218 may issue a local number portability (LNP) query 511 to the IP local number portability database 122. The IP local number portability database 122 may then supply the call manager 218 with a routing number 512 if the dialed digits form a valid sequence. Where the dialed digits do not form a valid sequence, the call manager 218 will return an error indication to the broadband residential gateway 300. The error designation may include a tone and/or a more detailed error message for display on, for example, display 338.

Detail Description Paragraph - DETX (117):

[0139] 4. On receiving the completed dialed digits, the call manager 218 may issue a local number portability query 610 to the IP local number portability database 122. The IP local number portability database 122 may then supply the call manager 218 with a routing number 611 if the dialed digits constitute a valid sequence.

Detail Description Paragraph - DETX (134):

[0156] Although the IP voice packets for these calls are typically routed over the IP network 120, the system may, where appropriate, route IP voice packets over the Internet 180.

Detail Description Paragraph - DETX (149):

[0171] U.S. patent application Ser. No. TBD (Attorney Docket No. 03493.83117; Client Reference No. 1999-0183), entitled "Automatic Port Status Reporting and Selective Call Barge-in For a Broadband Voice Over IP Telephony System and Method"" invented by Kung et al.

Detail Description Paragraph - DETX (153):

[0175] U.S. patent application Ser. No. TBD (Attorney Docket No. 03493.81765; Client Reference No. 1999-0230), entitled "Conference Server for Automatic X-Way Call Port Expansion Feature", invented by Kung et al.

Detail Description Paragraph - DETX (160):

[0182] U.S. patent application Ser. No. TBD (Attorney Docket No. 03493.81770; Client Reference No. 1999-0235), entitled "User Programmable Port Hunting in an IP Based Customer Premise Equipment," invented by Kung et al.

Detail Description Paragraph - DETX (183):

[0205] U.S. patent application Ser. No. TBD (Attorney Docket No. 03493.82496; Client Reference No. 1999-0309), entitled "Personal Control of Address Assignment & Greeting Options for Multiple BRG Ports," invented by Kung et al.